

3/28/18

This spreadsheet is a work in progress (DRAFT), being revised as our understanding of oil exploration, leasing and development as well as our understanding of the information needed to evaluate those activities increases. Studies may be added or removed over time. Notes about how studies might be conducted, who potential partners might be or other information does not reflect a commitment by those agencies, including the FWS if studies included here are the responsibility of another agency.

Short List identifies the studies currently considered to be the highest priority information needed in 2018.

EDIT HERE: Full List is all of the studies identified in the Resource Assessments led by FWS staff in February 2018. If you have access, please make changes to this page, then copy the rows to other pages.

Polar Bear Studies: Information from Table 1 in the Polar Bear Resource Assessment breaking down costs for the proposed studies.

Bird Studies: The Priority Information Need for birds is in the Full List and Short Lists as a lump sum request. This sheet provides a breakdown of costs by specific tasks.

Further information about studies completed and more context of the proposed research can be found in the Resource Assessments available upon request or within FWS on the R7 Common Drive 1002 Arctic Refuge folder.

3/26/18 PLEASE REVISIT BEFORE USING THIS WORKBOOK, AS IT IS CHANGING FREQUENTLY

Please contact Wendy Loya wendy_loya@fws.gov or Paul Leonard paul_leonard@fws.gov for more information.

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Assessments

	Purpose	Need
Acoustic Environment	Characterize responses of noise-sensitive resources (subsistence and listed wildlife species, subsistence users, residents, and Refuge visitors) to specific noise metrics.	To support pre-development impact analyses and inform specification of stipulations / mitigation requirements necessary for avoiding or minimizing adverse impacts of noise on sensitive wildlife, subsistence users, residents, and Refuge visitors.

<p>Acoustic Environment Quantify acoustic characteristics of specific development-related noise sources.</p>	<p>To support pre-development impact analyses and inform specification of stipulations / mitigation requirements necessary for avoiding or minimizing adverse impacts of noise on sensitive wildlife, subsistence users, residents, and Refuge visitors.</p>
<p>Acoustic Environment Establish baseline acoustic conditions.</p>	<p>development impact analyses (characterization of Affected Environment AND analyses of noise impacts in Environmental Consequences), enable monitoring designed for detecting and characterizing development-related changes in acoustic conditions and for determining the effectiveness of implemented stipulations / mitigation measures, and inform adaptive management (i.e., the need for refining</p>

Acoustic Environment

Predict the acoustic impacts of development-related noise in relation to distance from the source, landscape characteristics, and seasonal atmospheric conditions. To support pre-development impact analyses (characterization of Environmental Consequences), inform the design of acoustic inventory and monitoring efforts, and inform mitigation actions that ensure minimal impacts of development-related noise on sensitive resources.

Acoustic Environment	Establish long-term acoustic monitoring.	To support detection / characterization of development-related changes in acoustic conditions, determine efficacy of noise-related stipulations and mitigation requirements, and inform adaptive management.
Air Quality	Begin monitoring air quality in 1002 area	Clean Air Act (CAA), National Environmental Protection Act (NEPA), Federal Land Policy Management Act (FLPMA), Refuge Improvement Act and the Wilderness Act, Alaska National Interest Lands Conservation Act (ANILCA), and Arctic NWR Comprehensive Conservation Plan (CCP).

Air Quality	Protect resources during drilling and operations.	Area of the Arctic National Wildlife Refuge. Northern Alaska federal lands such as Arctic NWR and Gates of the Arctic (National Park Service) require quantitative, not qualitative, AQ and AQRV analysis. Significant modeling and interpretation are required to conduct these analyses.
Air Quality	Compile information needs for EIS development.	Existing monitoring data are likely insufficient to support Air Quality (AQ) and Air Quality Related Values (AQRV) analyses, which are required for oil and gas exploration and development EISs on federal lands.
Air Quality	Understand natural vs. anthropogenic methane sources	Identify air pollutants such as benzene from new, reconstructed and modified oil and gas sources, while providing greater certainty about Clean Air Act

		exploration and development in the 1002 Area of the Arctic National Wildlife Refuge. Northern Alaska federal lands such as Arctic NWR and Gates of the Arctic (National Park Service) require quantitative, not qualitative, AQ and AQRV. Significant modeling and interpretation are required to conduct these analyses.
Air Quality	Determine anticipated future air quality during development and operations	
Air Quality	natural resources	airborne contaminants.
Air Quality	Understand and protect visibility on the north slope	Ensure visibility for communities, aviation/transportation/industrial activities, land management/visitor use.
All Natural Resources	Extract information from existing technical reports and put into modern geospatial database. Ensure Documents are in a common repository.	Build off the existing science investment to expedite EIS

Birds

Assess how fragmented wetland habitat affects the impacts of disturbance to waterbirds.

The 1002 Area contains far fewer lakes and wetlands compared to areas to the west, but patchy high quality habitat does occur. This information is needed to assess if waterbirds respond differently to disturbance and displacement when proximate alternative habitat is of lower quality.

Birds

Determine use of coastal plain by raptors in late winter

To avoid conflicts between nesting raptors and industrial activities

Birds / Other Mammals	<p>Estimate abundance and species composition of major nest predators before, during, and after development to assess impacts of development on rates of predation on ground-nesting shorebirds and waterfowl. Determine distributions of nest predators to identify valuable nesting habitats.</p>	<p>Identify important nesting areas and habitats that provide protection from predation, assess impacts of development, and guide management actions to mitigate anthropogenic effects.</p>
Birds	<p>Design and populate a publicly accessible database for Refuge avian datasets.</p>	<p>Surveys and Studies conducted in the 1002 Area are not widely available. These data will be needed by a variety of stakeholders for leasing plans, EIS, and exploration and</p>

Birds

Provide contemporary information on breeding bird abundance, distribution, and habitat use patterns.

Define important areas and habitats for breeding birds to help guide leasing plans, EIS stipulations, and exploration and development activities.

Birds	Provide contemporary information on abundance, distribution, phenology, and habitat use patterns of non-breeding birds.	Identify important areas and key habitats for non-breeding birds to help guide leasing plans, EIS stipulations, and exploration and development activities and establish baseline data for future impact assessments.
Caribou	Analyze existing telemetry data to quantify seasonal ranges and migration routes	ANILCA, Int'l Agreement for Conservation of Porcupine Caribou Herd
Caribou	Monitor caribou movement to identify important areas, assess potential displacement by industrial activity, and investigate habitat use and effects on demographics	ANILCA, Int'l Agreement for Conservation of Porcupine Caribou Herd

Caribou	Investigate multi-decadal patterns of caribou use of the coastal plain during calving	ANILCA, Int'l Agreement for Conservation of Porcupine Caribou Herd
Coastal	Develop a better understanding of coastal and barrier island geomorphology	Understanding the coastline will be important if access to the refuge from offshore ice or waters is desired and to inform erosion modeling.
Coastal	Update shoreline erosion rate assessments	Coastal erosion will affect lands available for leasing, infrastructure siting, and potentially access from land to sea and vice versa.
Coastal	gravel deposits and identify habitat for coastal species out to approximately 20 m	support development and

Coastal

Establish baseline conditions and monitor change of benthic and water column biota assessments; microbes; fish surveys; community subsistence catch sampling

Coastal

change of coastal/lagoon water quality and

activities, including desalination/discharge could affect coastal ecosystems, including habitats that Threatened and Endangered Species depend on as well as fish to understand changes

Coastal

Contemporary and annually updated understanding of the timing, duration and morphology of nearshore sea ice.

To understand and evaluate both winter and summer coastal access for exploration and development, including sea ice roads and airstrips

Contaminants Establish baseline of contaminants in sensitive resources

To ensure contaminants of concern are below threshold levels during and after industrial activities in line with ANILCA (continued use of subsistence resources, and quality and quantity of water resources); National Environmental Policy Act (NEPA); Clean Water Act (CWA); Endangered Species Act (ESA); Marine Mammal Protection Act (MMPA)

Contaminants /Migratory Birds/Subsistence Updated baseline contaminant exposure information for birds breeding in the 1002 area

To ensure contaminants of concern are below threshold levels during and after industrial activities per ANILCA (continued use of subsistence resources)

Contaminants /Polar Bears Updated baseline contaminant exposure information for polar bears in the 1002 area

To ensure contaminants of concern are below threshold levels during and after industrial activities per ESA and MMPA

Cultural	Identification of cultural resource sites and their significance	<p>Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of its actions (in this case permitting oil and gas exploration and extraction) on historic properties (defined as prehistoric and historic objects, features, structures, sites, and districts).</p>
Oil Spills	Prepare information needed for spill response	Restoration (NRDAR);
Oil Spills	Under Mammals	Restoration (NRDAR); needed to understand how diversity of species is

Other Mammals Document the distribution and abundance of wolves and wolverines; document den site locations and habitat attributes; evaluate potential for disturbance or mortality related to interaction with human activities; and evaluate effects of increased access by subsistence hunters and trappers. To identify and reduce disturbance to wolf denning habitat

Wolverines	by expansion of neighboring populations; explore; monitor grizzly bear abundance, effectiveness of mitigation measures	provide baseline
Grizzly Bears	distribution, population, and trends	effectiveness of mitigation measures
Permafrost/Active Layer	within the 1002 area; active layer depth to vegetation and soils	mitigation; permitting winter exploration
Polar Bears	of Satellite Radio Collars for Polar Bears	numbers and make
Polar Bears	of a Population Monitoring Plan for SBS Polar	area negligibl impact
Polar Bears	III:Implementation of Population Monitoring	area negligibl impact
Polar Bears	Annual Den Detection and Monitoring Plan	area negligibl impact
Polar Bears	Polar Bear Den Detection and Monitoring	area negligibl impact
Polar Bears	Habitat Use Patterns of Polar Bears in the	area negligibl impact
Polar Bears	Community Perspectives and Use of Polar	area negligibl impact
Polar Bears	Bears in the 1002 Area (FWS)	area negligibl impact
Polar Bears	Response to Anthropogenic Disturbance	area negligibl impact
Polar Bears	Efficacy of Existing Mitigation Measures	subistence hunting
Polar Bears	Development of New Mitigation Measures	and Mitigate impacts to
Snow	Create and/or Evaluate Snow Distribution Models	and Mitigate impacts to
Snow	1002 area	and Mitigate impacts to
Temperatures	1002 area	establish minimum snow erosion from Low-Ground

Soils	Characterize soil types in 1002 area	A finer-scale soil map is needed to understand variation in soil structure and freezing patterns to support winter exploration as well as to understand factors affecting infrastructure placement such as wetlands, hydrology and permafrost.
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Subsistence	Compile new and historical information on archaeological, ethnographic and subsistence work that has been completed for Arctic Refuge's 1002 area in a database and ensure associated documents are catalogued.	To provide information needed EIS and for Sec 810 analysis.
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Subsistence	Establish the economic value of caribou to subsistence users	To meet the requirements of ANILCA and International Treaties
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Subsistence	Establish a Subsistence Harvest Monitoring Program	To ensure long-term conservation of fish and wildlife subsistence species and subsistence uses for qualified subsistence users (ANILCA)
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Subsistence Gather Oral Histories and Traditional Knowledge Study to guide management

To benefit historical site protection and guide management decisions and guide setting priorities for surveys and research in the 1002 area

Vegetation
Vegetation Quantify long term effects of seismic exploration on vegetation, protecting vegetation and soils during

but it is unclear what the standards should be for

The Coastal Plain of the Arctic National Wildlife Refuge has been identified by visitors as important for experiencing wilderness, vastness, remoteness and isolation, a sense of adventure and natural conditions (Christensen & Christensen 2009).

Understanding current visitor experience opportunities will assist the agencies in focusing their evaluation of effects to the view- and soundscapes. We anticipate that this evaluation will be requested during scoping for NEPA.

Visitor Use In order to evaluate, and possibly minimize, the effects of oil and gas development and infrastructure upon visitors, and commercial operators that support those visitors, it will be important to understand visitor experience opportunities.

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Natural Resources

Water

and applicability to 1002 area where topography, vegetation and hydrology are

Characterize seasonality in water quantity and quality in primary rivers of 1002 area.

achieve desired results and warrant science.

Knowing the seasonal availability of water is essential to make informed decisions and water permitting relative to oil and gas activities and fish and wildlife habitat needs.

Water	<p>Characterize seasonality in water quantity and quality in primary rivers of 1002 area.</p>	<p>Knowing the seasonal availability of water is essential to make informed decisions and water permitting relative to oil and gas activities and fish and wildlife habitat needs.</p>
Water	<p>The NHD is a spatially georeferenced digital dataset representing the natural and human altered hydrologic features (rivers, streams, lakes, canals, gages, dams & coastlines) of the United States. In Alaska the NHD also serves as the primary spatially georeferenced base layer to which most other geospatial data such as land status, vegetation and wildlife data is spatially</p>	<p>NHD could be done for 1002 area using newly acquired IFSAR imagery</p>
Water/Contaminants	<p>Develop an integrated understanding of surface and groundwater</p>	<p>To inform transportation planning, water withdrawal permitting, and eventually infrastructure planning</p>
Water/Fish	<p>Characterize the contribution of aufeis (sheet-like mass of ice that forms from successive groundwater flow during freezing temperatures) to river flow and habitat.</p>	<p>To inform transportation planning, water withdrawal permitting, and eventually infrastructure planning</p>
Water/Fish	<p>To understand factors regulating fish and waterbird habitat</p>	<p>withdrawal permitting,</p>

Public Health

To understand the benefits and impacts of oil and gas exploration and development on communities in and around the 1002 area of the Arctic National Wildlife Refuge

Requirement or standard practice for Northslope EIS

/Contaminant

Identify fish and wildlife habitat associated with lakes

Infrastructure planning, to ensure contaminants of

Land Cover (Vegetation)

Develop an updated a Vegetation Map

To permit and/or guide seismic, tundra travel, water/snow use and infrastructure planning

Land Cover (Wetlands)

Create an updated wetlands map to provide guidance to industry and land managers

Section 404 - establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands

WSR Interim management

Identify setback perimeter necessary to preserve viewshed for Hulahula River, and determine if buffers are necessary within the project area for Marsh Fork-Canning and Kongakut River corridors (Cultural ORV)

WSR Interim management

Document baseline acoustic conditions (including natural quiet) to preserve experience qualities within MF-Canning, Hulahula, and Kongakut River corridors (Recreational and Cultural ORV)

Compliance with FWS guidance for interim management of suitable rivers under consideration by Congress for inclusion in the National Wild and Scenic River System, to support impact mitigation and adaptive management.

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Permanent
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RMDs
Development
Seismic &
Explorer

Recommended Action

Although much general information is available, specific disturbance-response information is needed to quantitatively or qualitatively characterize relationships between noise metrics and response metrics for noise-sensitive resources including wildlife (especially caribou and polar bears), residents and subsistence users, and Refuge visitors on the coastal plain and in adjoining Wilderness. The recommended action is to work in partnership with subject matter experts (SMEs) to determine how noise may impact specific resources. In some cases, needed information may be obtained or derived from existing sources. In other cases, new research may be needed.

Although some general acoustic information is available, impact analyses and specification of stipulations / mitigation requirements will benefit from specific acoustic information associated with specific development activities that are anticipated or proposed for the 1002 Area. Such information is analogous to emissions inventory data. The recommended action is to acquire reliable data for acoustic characteristics of development-related noise sources. If possible, direct measurements of analog noise sources (i.e., development activities at existing North Slope oil and gas facilities) should be done for those sources that are expected to generate the greatest noise levels over the full course of development. Such data generally are lacking for North Slope oil and gas operations.

Baseline acoustic data for the 1002 Area are completely lacking, with the exception of short-term data collected in the extreme northwest corner of 1002 Area in support of the Point Thomson EIS (USACE 2012). The recommended action is to design and implement a baseline acoustic inventory project to support impact analyses, long-term monitoring, and adaptive management. Baseline acoustic conditions should be quantified for those specific geographic locations and time periods where and when anticipated development activities are expected to coincide with high resource sensitivity.

The recommended action is to conduct spatial noise propagation modeling as a means of predicting / estimating the acoustic impacts specific types and levels of development-related noise in relation to distance from the source, landscape characteristics, and seasonal atmospheric conditions.

The recommended action is to design and implement a long-term acoustic monitoring program in collaboration with SMEs for specific sensitive resources. Objectives of the program would be to detect and characterize development-related changes in acoustic conditions in determining the efficacy of noise-related stipulations and mitigation requirements, and inform adaptive management. This necessitates that changes attributable to development be distinguished from changes not attributable to development.

Establish long-term NAAQS ambient monitoring stations at the village of Kaktovik in the Arctic 1002 area and downwind in sensitive areas including monitoring and study sites.

After addressing data suitability and developing long-term NAAQS monitoring stations, conduct AQ and AQRV analyses for the Arctic N 1002 Area, using Near Field Modeling (AERMOD) and Far-Field Modeling (North Slope Regional Air Quality Modeling – NS RAQM).

Review (including exploratory modeling) of existing monitoring data and potential substitute data. Also requires information on geographic area, nearby sensitive resources, and impact of operations. For seismic operations, could take 1 week - 1 month after receipt of complete application. For exploratory drilling and production, could take six months after project is clearly defined and NEPA alternatives exist. Typically, reviews are conducted by BLM Air Program and USFWS Branch of Air and Water Quality Resources.

Establish ethane/methane monitoring station at Toolik and a coastal site (to be determined), which will help in source attribution of methane from industrial activities. The Arctic tundra can be a significant source of methane, so seasonal and interannual variation in baseline emissions is needed.

Collecting sufficient data to inform the NPR-A draft EIS took two years and utilized considerable BLM/FWS staff, significant contractor assistance, and additional agency (EPA) coordination. There is an existing BLM contractor working on the Reasonable Foreseeable Development (RFD) for the Alaska North Slope Regional Air Quality Modeling study (NS-RAQM study). This work is targeted to be completed by Summer 2019.

resources, vegetation, wildlife and subsistence hunting, fishing, and foraging.

Continue funding a long term “Interagency Monitoring of Protected Visual Environments” (IMPROVE) data collection at Toolik Lake Field Station. IMPROVE is an extensive long-term monitoring program to establish the current visibility conditions, track changes in visibility, determine causal mechanism for the visibility impairment in the National Parks and Wilderness Areas. IMPROVE obtains the necessary quality, meteorological, and emission data to identify the sources contributing to visibility impairment and their frequency, duration, and contribution to visibility impairment. In addition to source attribution, special studies have been performed to enhance the science of visibility monitoring and learn about aerosol physio-chemical-optical properties. Samplers make measurements of aerosol species, such as ammonium sulfate, ammonium nitrate, total organic carbon, fine soil, and non-soil potassium; light scatter; light extinction; and scenic images.

Cross reference existing technical reports to map any known areas of special values including Wild and Scenic Rivers, springs, subsistence use areas, and recreational areas (e.g. Canning River takeout). Identify data gaps in our knowledge in addition to those mentioned previously. The North Slope Science Initiative (NSSI) catalogue would be a possible location for the repository. Funding is for staff time or contractor to design database and compile information.

Conduct aerial- or ground-based inventories of Brooks Range, foothills, and Coastal Plain rivers for breeding cliff-nesting raptors. Because raptors may begin using the Coastal Plain while winter exploration activities occur, these surveys/studies should begin in the near future.

Monitor bird nests with cameras to estimate rates of predation in various areas and habitats, collect DNA samples to estimate abundance of mammalian nest predators that have been demonstrated to increase near development (e.g., red and arctic foxes), and monitor cyclical changes in abundance of alternate prey (lemmings) to determine what factors regulate predator populations and rates of predation on nests. Because high year-to-year variability will require data to be collected over many years, surveys and studies should begin as soon as practical.

The Refuge is working with FWS Science Applications to build a publicly accessible database for the long-term dataset for the Canning Delta tundra nesting bird project. Comparable efforts should follow for other projects to ensure appropriate storage and management of important data and allow for stakeholder access to both contemporary and historical data.

Conduct aerial- and ground-based surveys of breeding birds. Species groups should include waterfowl, loons, gulls, shorebirds, raptors, and landbirds should include both area-wide and intensive site-specific surveys. Because this information may be important to leasing, and because year-to-year variability will require baseline data to be collected over several years, surveys should begin as soon as possible. Ecological mapping data (vegetation, snow cover, elevation, etc.) should be determined at intensively monitored sites to allow fine-scale habitat modeling.

Use aerial surveys and remote tracking devices to determine use of deltas, lagoons, and the coastal plain by adult and juvenile birds outside the breeding season. Tracking or prior survey data should be used when available to narrow spatial coverage. Because intra- and inter-annual variability will require data to be collected over several years, surveys should begin as soon as possible. Habitat suitability data (e.g., water depth, prey biomass, substrate) should be acquired for key sites to allow fine-scale habitat assessments. For marine birds in nearshore coastal and offshore areas, conduct vessel-based surveys by collaborating with research projects and federal agencies. Combine resulting data with previous BOEM-funded marine bird surveys in the region (2016-2019) to provide a data archive, site or species specific analysis and distribution mapping for marine birds (this will add ~ave of \$100K/year; it can begin analysis and data archiving in 2019, and continue surveys in 2020).

A large database of telemetry data exists that could provide valuable baseline information on caribou movements. These data need to be formally analyzed to update the report "Sensitive Habitats of the Porcupine Caribou Herd" (International Porcupine Caribou Board, 1993); this information is needed to identify sensitive areas that may require special management during development and production. Funding is for time for a wildlife ecologist to analyze data and prepare a report, to be reviewed by wildlife biologists at federal, state and regional agencies. For marine birds in nearshore coastal and offshore areas, conduct vessel-based surveys by collaborating with research projects and federal agencies.

Monitoring data are needed to identify calving areas and seasonal ranges, to quantify caribou recruitment and survival, and assess relationships between habitat use, environmental factors (weather, forage, etc.) and demographic parameters. Focus should be on calving and post calving (summer) periods.

Telemetry data during the past 30 years has documented shifts in caribou distribution at approximately decadal intervals, possibly in response to decadal shifts in major climate drivers (PDO, AO, etc.) Determining abundance of antler specimens of various age classes (up to 2,500 yr BP) will provide a long-term data set with which to assess the relative importance of the Arctic Refuge during different climatic phases.

Obtain more information on coastal and barrier island substrates, including ice content/permafrost, sediment composition, grainsize, etc. Recent observations of brown tundra along coast suggest salt-kill of tundra due to inundation; sometimes recovers when apparently associated with storm surges, but some areas have not recovered since 1970's suggesting subsidence. GPS instrumented monuments across area coast would provide information on changes in elevation, and this could be a component of the BLE LTER monuments if not already. Continue studies to understand evolution and erosion of protective barrier islands (USGS).

Multiple research efforts are proposed or underway which need continued financial support. Sandia National Laboratories and partners have proposed developing a predictive model of thermos-abrasive erosion for the permafrost Arctic coastline, which will complement efforts by the Beaufort Lagoon Ecosystems LTER (See sec 4. Coastal Habitats) and BOEM's Wave and Hydrodynamic Modeling in the Beaufort (Stefansson Sound). USGS will conduct research on shoreline change in 2018 to understand coastal bluff and beach change.

CONTINUE SURVEYS WHERE COASTAL ACCESS IS NEEDED FOR DEVELOPMENT. DRAFTING WAS LAST COMPLETED IN 1940'S. MINISTRY HAS DONE WORK IN THEIR AREAS OF INTEREST IN THE CENTRAL BEAUFORT SEA

Although it will take several years to assemble the baseline, the BLE LTER will make significant contributions to this topic. Study of Fish nearshore Beaufort Sea planned by USGS in 2018.

Much of this baseline information will be collected as part of the BLE LTER funded by NSF

The Beaufort Sea Lagoon Long Term Ecological Research site (BLE LTER) funded by NSF will make significant contributions to this topic. FWS, BLM, BOEM and Industry should establish relationships with the researchers and establish data sharing protocols. Agencies or industry may want to partner or use similar methods to expand the monitoring network infrastructure associated with the BLE LTER.

Develop statistically sound contaminant monitoring program with enough power to detect biologically significant changes in contaminant concentrations, and changes in contaminants concentrations that may exceed regulatory thresholds. Evaluate sampling locations and matrices from previous contaminants baseline study for sufficiency as monitoring sites and matrices, and evaluate current data for suitability as baseline data. Add site-specific monitoring sites and matrices depending upon project description to provide baseline (project) data. For groundwater monitoring, include location, depth, and monitoring interval of groundwater wells that would identify changes from baseline specifically for springs.

Updated baseline contaminant exposure information for birds breeding in the 1002 area, and those using deltas and lagoons for fall staging, with particular emphasis on hydrocarbon and heavy metal exposure, and how contaminant burdens may affect subsistence values.

Continued collection of polar bear contaminants exposure data, with an emphasis on hydrocarbon and heavy metal exposure

Cultural resource investigations will be necessary to sufficiently identify cultural resource sites, determine the significance of such sites, evaluate effects to sites determined eligible under National Register of Historic Places criteria, and to determine avoidance, minimization, and mitigation standards for eligible sites that would be adversely affected by oil and gas activities. USFWS should commit one full-time GS-0193-11 archeologist to oversee agency cultural resource investigation permitting and Section 106 responsibilities during the duration of oil and gas exploration and extraction operations development.

management-application-erma/arctic-erma.html). These tools inform oil spill planning and response; those for the 1002 area, especially inland, may need to be updated to include, rivers, lakes, groundwater, springs; terrestrial habitats; soil, vegetation; species groups: birds (waterfowl, shorebirds, raptors, songbirds, seabirds), mammals (land mammals, marine mammals), fish (freshwater, saltwater), plants. These tools will be updated to reflect changes in the environment and to track changes over time. These tools will be updated to reflect changes in the environment and to track changes over time. These tools will be updated to reflect changes in the environment and to track changes over time. These tools will be updated to reflect changes in the environment and to track changes over time. There is a critical need for baseline information prior to development of the coastal plain. This information will be needed to

Record observations of wolves and wolverines and their tracks during late winter surveys for ungulates to obtain information on relative abundance and distribution. Develop a database of known den sites. Potential denning habitats of wolverines with kits should be mapped using satellite imagery or other methods.

Monitoring of habitat characteristics important to large carnivores. Could be built into ongoing monitoring work; primary cost would be additional staff time for data analysis plus ~\$20,000 per year for browser surveys. These data are needed to differentiate between natural and monitor occurrence and behavior of grizzly bears in relation to human activities. Estimated cost: \$30,000 per year plus \$100,000

Pleistocene Epoch paleontological resources (e.g. mammoth, steppe bison, horse and other Ice Age mammal fossils) that may be located using existing monitoring data and supplementing with additional field measurements, create a model that links vegetation, soils and active layer/permafrost dynamics to project landscape conditions for the 1002 area to facilitate winter transportation permitting evaluate emerging technologies (e.g., high-resolution satellite imagery, GPS collar reliability, collar drop off mechanism performance) building.

7. Research working with Canada on this sub-population occurs in both countries

- Conduct associated analyses and community coordination
- future predictions on how distribution and movement is likely to respond to predicted sea ice loss and other habitat changes. Phase I will include analyses to identify the characteristics of environmental and biological characteristics of polar bear denning habitat.
- Develop analyses to characterize natural resources and predict polar bears in the 1002 Area.

8. Research working with Canada on this sub-population occurs in both countries

implement a project to monitor sound levels and other forms of disturbance at polar bear den sites and concomitant polar bear response (facility location/design).

- informed by the previous two projects, modify current mitigation measures and develop novel measures to address characteristics of

9. Research working with Canada on this sub-population occurs in both countries

Soil surveys will need to be produced at a finer spatial resolution than is currently available (1:1,000,000). Recommend completing a 3 soil survey for the area (1:63,000), followed by level 2 by companies at development sites and along corridors. Completing a survey would inform distribution of soils, permafrost, wetlands, and vegetation communities. Conducting a survey across the 1002 would likely take 3 to 4 years and ~\$1 to \$1.5 million to complete. This includes staff time and field equipment. It could be completed faster but the cost would increase significantly (~3 to 7 million dollars depending if contracted or not) and the final product would likely be of poorer quality.

Create a functional repository and database of existing contemporary and historical data. Multiple sources of published and unpublished subsistence and harvest data reside with various agencies, organizations, tribal governments, and universities. The North Slope Science Initiative (NSSI) catalog would be a possible location for the repository. Funding is for staff time or contractor to design database and compile information.

Quantify the economic value of caribou and other subsistence harvest resources.

Alaska Department of Fish and Game intermittently interviews year-round households in a community to understand the quantity of subsistence harvest for all natural foods (e.g. fish, land mammals, marine mammals, etc.). A full study has not been done since 1992. In the absence of contemporary information and to understand evolving subsistence harvest, a community supported harvest monitoring program with implementation protocols based on timely and accurate harvest information is needed for communities relying on resources associated with the 1002 area, including caribou, fish, furbearers, birds, berries, etc..

Much valuable cultural, historic, and traditional ecological knowledge about the Refuge and the coastal plain (1002 area) is possessed by local elders. Oral histories and place names contain an enormous amount of information on traditional uses, culturally important places, historic camps and settlements, and other natural and cultural information.

Revisit plots sampled during 1988-2002 to assess long-term impacts of seismic surveys.

~~Review existing studies of impacts and recovery from seismic exploration currently occurring on North Slope, including information in the grey literature of Alaska DNR, RIM, NSR and others if existing and available.~~

A night sky monitoring study to document existing auroral, stargazing, and other astronomical resource conditions when there are dark skies, and potential future changes to existing night sky opportunities.

Viewscape: Visibility analysis exercise using GIS is needed to model extent from which infrastructure would be visible

Evaluate Refuge's raw 2010-2011 Client Use Report (CUR) data, consistent with previous data, to identify additional information specific to the Coastal Plain; and of Refuge's limited 2012-2017 CUR data (reporting requirements inconsistent with previous data).

Contract visitor use management researcher to evaluate existing visitor surveys for generalized information about Alaska Region's visitation patterns and preferences. The resulting product would be a comprehensive bibliography of known surveys, development of a database to house and compile found data, and a summary discussion paper.

Contract the analysis of studies related to visitor expectation in remote environments.

Re-evaluate 2009 visitor survey data held by Neal Christensen, to identify any possible additional information about experience conditions and expectations of visitors, specific to the 1002 Area of the Coastal Plain.

recommendations to improve Stips and ROPS and their applicability across the 1002 coastal plain with different topography, vegetation, and soil types.

Continue USGS operation of the Hulahula River stream gaging station and evaluate winter water availability.

Second priority would be to re-establish gages on the Canning and Tamayariak River and establish baseline water quality characteristics to evaluate the current status and natural variability in late fall, winter and spring surface water quality and quantity in relation to the timing of fish use and industrial activity. Compile information in a database that will be used for permitting and impacts analyses.

NHD could be done for 1002 area using newly acquired IFSAR imagery

Evaluate surface (including springs) and groundwater flow paths and recharge; develop conceptual groundwater model informed by isotope studies to delineate and age flow paths. Quantify river recharge rates to inform water withdrawal permits. (FY18-20 total cost: \$\$, potential leads: USGS and USFWS). In subsequent years, develop geospatial inventory of hydrologic connectivity, watershed areas and relative snowpack to assess lake vulnerability/recharge potential (FY18-20, leads: USGS, USFWS)

Identify open-water areas and aufeis-associated fish habitat and evaluate terrestrial mammal use of aufeis, aufeis contributions to late summer flows, and the importance of aufeis and ice-dam flooding in recharging fish and wildlife habitat in the Canning, Hulahula, Itkilyariak, Katakturak, and Sadlerochit river drainages (FY18/19 costs: \$, USFWS and USGS).

Continuous water level and winter water quality monitoring on representative lakes to evaluate current status and natural variability relative to timing of potential impacts of industrial activities and use by fish and wildlife (FY18-22, leads: USFWS, USGS, RIM)

The Liberty Draft EIS and Point Thompson Final EIS both include Health Impact Assessments for Kaktovik that may be further evaluated for site specific and cumulative effects for Kaktovik as well as other communities in or adjacent to the refuge (Arctic Village, Venetie) or those that rely on natural resources from the Refuge. Health Impact Assessments should include evaluation of: Social Determinants of Health; Accidents and Injuries; Exposure to Potentially Hazardous Materials; Food, Nutrition, and Subsistence Activity; Infectious Disease; Water and Sanitation; Non-communicable and Chronic Diseases; and Health Services Infrastructure and Capacity. Funding requested would be to secure a contractor to complete Health Impact Assessments.

macroinvertebrate and fish contaminant samples collected in up to 60 high-priority lakes, and e-DNA samples available to test for fish

Contract for an updated vegetation map for 1002 area. Form an expert group to identify elements of a SOW

An updated wetlands map at 1:24,000 scale is needed to identify wetlands and hydrographic relationships. Recent acquisition of IFSA imagery and proposed LiDAR acquisition by the North Slope Borough to USGS could contribute to improved landform and hydrologic mapping needed for a wetlands map. Completion of a map could take approximately 18 months, building off existing field survey effort, vegetation (FWS); desktop modeling from imagery for water flow and preliminary wetlands classification based off existing orthoimage, season of field validation followed by final map development and review.

Conduct field effort to specify the viewshed perimeter, or maximum perceptible visible distance (e.g: how far an individual person would be able to see from any place inside a river corridor), for each of the three suitable river corridors to document baseline conditions of visual resources described in the 2015 CCP WSR Review. This work will inform 1) setback determinations for the Hulahula River within the project area and/or extent of buffers to protect Marsh Fork-Canning and Kongakut River viewsheds outside the project area; and 2) inform thresholds for monitoring impacts to viewsheds during oil and gas activities and standards for reclamation assessments.

Conduct field effort to document baseline conditions for natural quiet, described in the 2015 CCP WSR Review. Data collected for noise attenuation in subsistence, visitor use and sensitive wildlife areas; and specific landscape characteristics and seasonal atmospheric conditions, will be essential to model spatial predictions of acoustic impacts and establishing thresholds for monitoring during oil and gas activities, and standards for reclamation.

conduct agency cultural resource investigation in 2019-2020.

Projected Annual Cost

Number of years

\$150,000

1

\$125,000 / yr + \$55,000 one-time
equipment cost

4

\$100,000

The cost estimate is a
guess - assumes that
this work is contracted
to support preparation of
the leasing plan.

\$125,000

6

Annual operating cost estimates depend on the type of site and equipment selected and range between \$250-\$300K depending on the remoteness and accessibility of the site, availability of power and data telemetry options, and availability of local site operators. Depending on the number of parameters being monitored 1-2 FTE may be required for routine site operations.

\$200K	2	
1-4 technical specialist FTEs from BLM/FWS. and data analysis . 1/4 - FTE for QA per site. \$25-75K per site for power, parts and supplies, travel to site (depends on remoteness and accessibility of site and online power)	Seismic operations: 1 month; exploratory drilling/production: 6 months	
	6	

\$50 K	1
\$37K	6

\$30,000

1

\$5,000

\$75,000

4

\$20k

1

\$175,000 See cost breakdown for
components on next sheet

\$150k

3+

\$0

1

\$500,000

6

\$50,000

1

\$600-800k

\$30,000

4

0 if done during ungulate surveys 5

\$20,000 in addition to ungulate	
surveys costs	5
\$30,000-\$100,000	6
\$75k	1
\$250,000	1
\$200,000	1
\$2,500,000	Annually
\$150,000	1
\$1,300,000	4
\$200,000.00	Annually
\$450,000	4
\$250,000	4
\$150,000	3
Initiation (NRCS contribution would decrease)/ \$13k per annum SNOTFI	1+

- *If FWS develops expertise: \$150k in new salary cost, \$150-200k helicopter and travel
 - *If FWS - 4 yrs
 - contracted to NRCS: \$300k plus helicopter and travel
 - NRCS contract - 3 yrs
 - Outside Contractors - 3 yrs
- *If contract to outside contractor:
~\$3 million

\$50,000

1

\$75,000

3

\$46,000

\$120K

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\$5K

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\$10K

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\$20K

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\$25K

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\$25K

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?

2

\$60k, funded for FY18

5

Variable

\$100K ?

2

\$50-\$100K

1

\$158,150

2

\$100K for Vegetation; \$100K for
Hydrography

1

\$60K

1

No additional cost if completed in
conjunction with effort to field
effort to specify the viewshed

perimeter data

\$100K

1
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Comments**First Stage needed (dropdown list)**

Difficult to estimate costs at this time, pending discussions about new research needs with SMEs for other resources. Resource-specific disturbance-response information, acoustic characteristics of prospective development-related noise sources, and spatial propagation modeling together could provide the basis for stipulations such as: (1) For all drilling operations within xx,xxx (e.g, 10,000) meters of sensitive resource location yyyy (perhaps during a time period of particularly high sensitivity), apply a controlled surface use (CSU) stipulation that requires implementation of noise-mitigation efforts to achieve a minimum of xx dB reduction in total sound power produced by the drilling operation. This xx,xxx distance corresponds to the maximum modeled propagation distance of the noise level generated by unmitigated drilling operations. (2) Apply a no surface occupancy (NSO) stipulation within xxxx (e.g., 4,100) meters of sensitive resource location yyyy. This distance corresponds to the maximum modeled propagation distance of the noise level generated by drilling activities that have implemented noise-mitigation techniques to reduce noise levels by at least xx dB. OR, AN ALTERNATIVE TO IMPLEMENTING NOISE-MITIGATION EFFORTS (3) For all drilling operations within xx,xxx (e.g, 10,000) meters of sensitive resource location yyyy, apply a timing limitation (TL) stipulation that restricts all drilling operations to the period of time when there is zero resource sensitivity to noise (for whatever reason).

Pre-Development Baseline

Sources. Reliable data (noise measurements) are particularly needed for those noise sources that are expected to generate the greatest noise levels - e.g., drilling operations; gas compression facilities; other processing facilities; low-altitude aircraft flight, take-off, and landing; and blasting [perhaps difficult to mitigate other than by specifying timing limitations designed to avoid impacts during periods of high resource sensitivity]. Reliable aircraft data are available from the FAA's AEDT model and other sources (see write-up), but reliable detailed data for North Slope oil and gas activities generally are lacking and warrant direct measurement. Relevant measurements could be collected at existing O&G facilities on the North Slope (e.g., Prudhoe Bay, Kuparuk, Alpine, GMT...) during relevant time periods. The cost estimate is a guess - assumes a contractor is paid to design, implement, travel, analyze, report. Data should be collected for a length of time that is sufficient for adequately characterizing temporal variability in noise levels. For an example, see Ambrose and Elsenbeck (2011) and the USACE (2012) for the Arctic National Wildlife Refuge, with the exception of short-term data collected in the extreme northwest corner of 1002 Area in support of the Point Thomson EIS (USACE 2012). The spatiotemporal sampling design for baseline inventory work should be developed (1) in collaboration with SMEs for sensitive resources and (2) simultaneously with the design for long-term monitoring. The spatial design also could benefit from preliminary spatial noise propagation modeling. In the absence of propagation modeling and detailed design discussions with other SMEs, a preliminary cost estimate is based on the following assumptions: 1. Acoustic inventory and monitoring program can be run by a full-time GS-9 physical scientist / ecologist / biologist (~\$95k/yr, assuming cost escalation); 2. \$5,000 backcountry travel / yr; 3. \$25,000 / yr helicopter transport; 4. \$55,000 one-time equipment cost for 5 acoustic monitoring systems (sound level meter, digital audio recorder, associated equipment) @ \$11,000 ea; 5. the 5 systems are rotated among 20 total inventory & monitoring sites over a 4-year period (i.e., ~complete baseline requires four years of data collection, and subsequent monitoring data are acquired via the Pre-Development Baseline

See comments above for baseline inventory. The cost estimate is based on cost assumptions used for the simple inventory design described above, and on the assumption that monitoring is implemented with the first set of repeat visits in year 5. But alternative models should be considered - e.g., particularly sensitive sites (e.g., Kaktovik) may warrant annual monitoring. Also, if some metrics are expected to have high degree of interannual variability, then more frequent monitoring may be required (perhaps for a short time period, coinciding with period/s of high resource sensitivity) in order to quantify temporal variability and enable changes / trends to be detected and acted upon sooner. Perhaps high-frequency (~annual) monitoring at selected sites of importance is done with a larger number of less expensive audio recorders, whereas low-frequency (4-yr) monitoring is done with sound level meter. Lots of design issues to consider.

Pre-Development Baseline

Project startup cost depend on site logistics, accessibility, power requirements, equipment selected (thermostatically controlled shelter, telemetry) and selection of pollutant analyzers. Costs can range around \$500k/site for installation. Initial project costs could be scaled or spread out over two years.

Pre-Development Baseline

<p>An estimated \$150-200K would be required to add to the current contract to include the Arctic 1002 project, assuming that it could be modified and a clear funding source is identified. Contract option time frame of 24 to 30 months: initiating and awarding contract (3-4 months); complete contract work (12-15 months); review (3-6 months); incorporating work into NEPA document (3 months). Two years AFTER EIS alternatives are developed.</p>	<p>Development (Permanent Infrastructure)</p>
<p>Existing data may include satellite-based validation of NOx plumes from Prudhoe Bay and average patterns of potential pollution dispersion; limited NOAA/NWS/FAA data; BLM NPR-A ozone study; Toolik Lake Field Station research; and industry-sponsored PM speciation studies at Wainright and Deadhorse.</p>	<p>Pre-Development Baseline</p>
<p>Startup cost = \$125-300K /site for installation, thermostatically controlled shelter, telemetry. (Cost depends on remoteness and accessibility of site, power, and number of parameters to be measured)</p>	<p>Pre-Development Baseline</p>

Can use the results of NS-RAQM. Completion of NS-RAQM is October 2019. Modeling results will be available in Spring of 2019.

Startup cost = \$15K

Pre-Development Baseline

Pre-Development Baseline

Pre-Development Baseline

Winter Seismic & Exploree. Dr

EIS Stips and BMPs

Development (Permanent Infrastructure)

Nest monitoring study is ongoing (funded at >\$75,000/yr). This proposal is to supplement existing work by adding a study of predator populations.

Pre-Development Baseline

Pre-Development Baseline

Winter Seismic & Explore. Dr

In progress

EIS Stips and BMPs

long term monitoring program; This proposal is to increase the monitoring intensity above current levels (to approximately twice Pre-Development Baseline the current level)

Field work completed 2018, data analysis is ongoing

Pre-Development Baseline

Development (Permanent Infrastructure)

Development (Permanent Infrastructure)

Development (Permanent Infrastructure)

Pre-Development Baseline

Pre-Development Baseline

Winter Seismic & Explore. Dr

The USFWS does not currently have sufficient Environmental Contaminants staff to conduct or review studies, or evaluate NEPA documents, for oil and gas exploration or drilling in the 1002 area.

Pre-Development Baseline

Pre-Development Baseline

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Pre-Development Baseline

Development (Permanent Infrastructure)
Pre-Development Baseline
Pre-Development Baseline

long term monitoring program

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Winter Seismic & Explor. Drilling
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Winter Seismic & Explor. Drilling

Pre-Development Baseline

EIS Stips and BMPs

EIS Stips and BMPs

This project should be funded for 3 years: 1 to establish monitoring program and implement; 2nd and 3rd years conducting monitoring program. There's to great a variance in seasonal availability of resources, changing weather and access variables, and unpredictable changes in migrations routes and patterns. Ideally, this 3 year monitoring program should be repeated at least every decade, and if possible every 5 years. 5 year break between monitoring cycles.

Pre-Development Baseline

Pre-Development Baseline

completed 2018

Development (Permanent Infrastructure)
Development (Permanent Infrastructure)

Duration: eight months, August-April when dark skies are present, with sampling during one week/month at the new moon when auroral activity is forecast to be at its lowest, and during one week/month at the full moon when auroral activity is forecast to be at its highest to capture variability caused by auroral activity; lead: to be determined, contracted to NPS Natural Sounds/Night Skies program for use of equipment and implementation; cost: \$120K (estimate based on initial camping field equipment cost of \$5K; recurring transport cost from Fairbanks to remote site of \$5K for each of 16 sampling sessions; and \$300/day or \$2K for each of 16 sampling sessions

Viewscape: Duration: one week for two staff; lead: USFWS R7
Realty staff; cost: none, except staff salary estimated at \$5K

Duration of effort: 6 months; lead: Jennifer Reed; cost estimate: \$10K for contracted database support

Duration: 6 months; lead:??; cost: \$20K

Duration: 6 months; lead: Jen Reed; cost: \$25K

Lead - Roger Kaye

Original project was related to aquatic environments, but should cover all resource areas

EIS Stips and BMPs

Hulahula gauge is currently funded through FY18.
Review/update IAA to allow USGS to conduct hydrologic investigations across the coastal plain.

Winter Seismic & Explor. Drilling

Tamayariak and Canning River have historic information, but hydrologic regimes are shifting and current information will allow Pre-Development Baseline for better informed management decisions.

Mapping project with follow up ground truthing.

Pre-Development Baseline

Winter Seismic & Explor. Drilling

Pre-Development Baseline

Pre-Development Baseline

EIS Stips and BMPs

Initial WORK IN PROGRESS. (PT 10 COST: \$70,150, PT 19 COST: \$92,000,
Lead: Greta Burkert, John Trawicki, Phaedra Rudy, Angela Metz

Winter Seismic & Explor. Drilling

An accurate, updated vegetation map is essential for working with Industry to permit seismic and winter tundra travel. FWS would work with BLM and others to define the scope to meet the management needs and then FWS staff and contractor(s) would complete the task as defined. Timeline to completion is approximately 1.5 to 2 years. Cost estimate would cover all work.

EIS Stips and BMPs

FWS and BLM do not appear to use NWI mapping and classification information directly in their evaluation and permitting; Army Corps may. BLM does not have a NWI map for Development (Permanent Infrastructure) NPRA. A higher resolution, higher accuracy vegetation map is of greater use to FWS, at least initially.

Both viewshed and acoustic baseline data collected in same field effort for Hulahula, MF-Canning, and Kongakut Rivers (estimate \$20K per river). Builds off existing WSR Study-identified resources. Regulatory in that it demonstrates compliance with interim management guidance for suitable WSR corridors. Permiter data should be used to inform Stips/ROPs regarding river setbacks and buffers.

Pre-Development Baseline

Both viewshed and acoustic baseline data collected in same field effort for Hulahula, MF-Canning, and Kongakut Rivers (estimate \$20K per river). Builds off existing WSR Study-identified resources. Regulatory in that it demonstrates compliance with interim management guidance for suitable WSR corridors. Permiter data should be used to inform Stips/ROPs regarding river setbacks and buffers.

Pre-Development Baseline

NSOs and buffers.

Pre-Development Baseline

**Does this build on
existing efforts?**

Regulatory

**needed to inform selection of ships and
ROPs**

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**USGS Comments on US/US/10
via John Pearce**

FWS Comments

does not have the funding to establish and operate the site, but has committed to assist with the contract scope and overview. Baseline air quality data are needed to meet requirements under the Clean Air Act (CAA), National Environmental Protection Act (NEPA), Federal Land Policy Management Act (FLPMA), Refuge Improvement Act and the Wilderness Act, Alaska National Interest Lands Conservation Act (ANILCA), and Arctic NWR Comprehensive Conservation Plan (CCP).

	<p>Existing data may include satellite-based validation of NOx plumes from Prudhoe Bay and average patterns of potential pollution dispersion; limited NOAA/NWS/FAA data; BLM NPR-A ozone study; Toolik Lake Field Station research; and industry-sponsored PM speciation studies at Wainright and Deadhorse.</p>

The Toolik Station Monitor has been funded for installation and operation for the next 5 years. Ongoing funding will need to be acquired to continue this long term air quality monitoring project.

Science Applications working on geospatial database with advice from Refuge staff and will expand to other divisions

USGS is completing an analysis of USFWS Arctic Coastal Plain waterbird aerial survey examining change in abundance and distribution of species over a 26-year period for entire Arctic Coastal Plain (includes NPR-A, Prudhoe Bay, and 1002 area). Final product to be available in September 2018. Additional analyses could be undertaken depending upon need.

USGS is conducting research on the Central Arctic Herd. USGS is exploring possible engagement with the Porcupine Herd Technical Committee who hold and manage data relative to this resource need.

This study appears to be nearly complete by Porcupine Caribou Technical Committee (Mike Sujor, Canada as lead). Research findings are in internal review by PCTC; some uncertainty about publishing given uncertainty about PCTC

USGS is conducting research on the Central Arctic Herd. USGS is exploring possible engagement with the Porcupine Herd Technical Committee who hold and manage data relative to this resource need.

This proposal includes increasing the monitoring intensity to approximately twice the current level to improve precision of birth and survival rates.

Could occur in 2018 or 2019

Applicant is responsible for and required to comply with Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of its actions (in this case permitting oil and gas exploration and extraction) on historic properties (defined as prehistoric and historic objects, features, structures, sites, and districts).

Applicant is responsible for and required to comply with Section 106 of the National Historic Preservation Act.

by MMP

by MMP

by MMP

by MMP

Dr. Matthew Sturm of UAF was able to order to get out as soon as possible). I

Second, individual items
MAY NOT have a snow extent

This is a significant effort requiring comprehensive planning for several years out. In NPRA, industry has contracted ABR to develop integrated terrain units to capture vegetation, soils, landscape, habitat and other characteristics.

A conversation with ADFG is needed;
Wendy will try to find out more ASAP.
Otherwise, the EIS contractor may be able
to do this as part of the subsistence
impacts and Section 810 analysis?

Currently USGS operates gage on the Hulahula River. Arctic Refuge contributed \$25K in FY18 to continue gage activity. Support in outyears TBD.

Quick Response and Science Support funding? Arctic LCC has some hydrology/meteorology equipment possibly available via USGS from TEON site on Agashashok River. Also, planning to have conversations with NOAA about collaborating on data use and delivery of monitoring data. Could be opportunity to work with USGS Cooperative Unit at UAF

This is a recommended component of the
EIS

Brian Wright at USGS has provided cost estimate for work. Lidar flights are planned in FY18 over populated areas of the North Slope by a contractor.

FWS is working with Scott Guyer and Ducks Unlimited on a Statement of Work to refine the request for an updated vegetation map. Further conversations among FWS regulatory staff, Nicole Hayes and others may lead to the need for a high quality, high resolution vegetation map as serving the same purpose and more as an updated NWI classification map. LiDAR requested by NSB is insufficient for 1002 planning purposes, but FWS could make a future request from the USGS 3DEP program for LiDAR to complete hydrography mapping.

oric Preservation Act requires federal agencies to take into account the effects of its actions (in this case permitting oil a

nd gas exploration and extraction) on historic properties (defined as prehistoric and historic objects, features, s

structures, sites, and districts).

Recommended studies to be include in EIS:

Resource	Purpose	Need	Recommended Action	Projected Annual Cost	Number of years (0 to 6 If >5)	Regulatory	Needed to inform Selection of Stip. and ROPs	Needed for Exploration (Seismic, drilling)	Does this build off existing studies?	Baseline Study	Priority?	USGS Comments on 03/02/18 via John Pearce	FWS Comments via Wendy Loya						
All Natural Resources	Extract information from existing technical reports and put into modern geographic database. Ensure Documents are in a common repository.	Build off the existing science investment to expedite EIS		\$30,000	1	0	1	1	1	0	1		Identification of known special areas should be included in the EIS						
Public Health	To understand the benefits and impacts of oil and gas exploration and development on communities in and around the 1002 area of the Arctic National Wildlife Refuge	Requirement or standard practice for Northslope EIS	The Liberty Draft EIS and Point Thompson Final EIS both include Health Impact Assessments for Kaktovik that may be further evaluated for site specific and cumulative effects to Kaktovik as well as other communities in or adjacent to the 1002 area. Various communities that rely on natural resources from the Refuge. Health Impact Assessments should include evaluation of: Social Determinants of Health; Accidents and injuries; Exposure to Environmental Hazards; Mental Health; Nutrition, and Substance Activity; Infectious Disease; Water and Sanitation; Non-Communicable and Chronic Diseases; and Health Services Infrastructure and Capacity. Funding request would be to secure a contractor to complete Health Impact Assessments.	\$50-\$100K	1	0	1	1	1	1	1		This is a recommended component of the EIS						
Subsistence	Compile new and historical information on archaeological, ethnographic and subsistence work that has been done for Arctic Refuge's 1002 area in a database and ensure related documents are catalogued.	To provide information needed EIS and for Sec 810 analysis.	Create a functional repository and database of existing contemporary and historical data. Multiple sources of published and unpublished subsistence use and harvest data reside with various agencies, organizations, tribal governments, and universities. The North Slope Science Consortium has a potential location for the repository. Funding is for staff time or contractor to design database and compile information.	\$50,000	1	0	1	1	1	1	1		Likely to be a component of the EIS.						
Subsistence	Establish a Subsistence Harvest Monitoring Program	To ensure long-term conservation of fish and wildlife subsistence species and subsistence uses for qualified subsistence users (ANILCA)	Interviews, questionnaires, workshops, etc. are necessary to understand the quantity of subsistence harvest for all natural foods (e.g. fish, land mammals, marine mammals, etc.). A full study has not been done since 1992. In the absence of contemporary information and to understand the subsistence harvest, a comprehensive harvest monitoring program with implementation protocols based on timely and accurate harvest information is needed for communities relying on resources associated with the 1002 area. Information needed for this analysis is available in the 1992 study.	\$50,000 - \$100,000	1	1	1	1	1	1	1		Part of the EIS. BLM has talked to the state to see if state has funding to lead this task. The EIS comment may be able to tie into the part of the subsistence impacts and Section 810 analysis.						
Polar Bear Studies for MMPA/ESA																			
Polar Bears	of Satellite Radio	determine small numbers and impact determination under	1 e.g. high-resolution satellite imagery, GPS collar	\$120,000	1		Winter, Seismic, or						3/30/18 by MMP						
Polar Bears	Amphibian Detection	Impact determination under	Requires working with Canada as this sub-population	TBD	1		Winter, Seismic, or						3/30/18 by MMP						
Polar Bears	Efficacy of Existing	Impact determination under	distribution and movement is likely to respond to predicted	\$150,000	1		Winter, Seismic, or						3/30/18 by MMP						
Studies that would inform Habitat Protection Stipulations/BMPs																			
Landcover	Develop an updated Wetlands Inventory Map, including National Hydrography Dataset (NHD), and a Vegetation Map	To permit and/or guide seismic, tundra travel, water/snow use and infrastructure planning	There is significant efficiency and cost savings in the cost of fieldwork to validate the NHD with associated hydrography, and a vegetation map, as much of the cost is associated with field work to validate the classifications. The 1002 area needs an updated Wetlands Inventory Map, including NHD and a vegetation map, every BLM or Corp of Engineers project. Coupling that with National Hydrologic Database Hydrography mapping is important to understanding the hydrology in the area. The NHD is largely incomplete in the 1002 area which is very different than NHD. An accurate, updated vegetation map is essential for working with industry to develop plans and guidelines for the 1002 area. The 1002 area is much taller than NHD, including large areas of tussock tundra which is highly susceptible to damage. An updated vegetation map and a hydrography map in collaboration with Ducks Unlimited. The 1002 area was not field-validated and is therefore lower accuracy and thus insufficient to meet planning needs. FWS would work with industry to determine the best approach to meet the management needs and then hire a contractor(s) to complete the task as defined. Timeline to completion is approximately 1.5 to 2 years. Cost estimate would cover all work.	\$100K for Vegetation; \$100K for Hydrography	1	2	1	1	1	1	1	Brian Wright at USGS has provided cost estimate for work. Lidar flights are planned in FY18 over populated areas of the North Slope by a contractor.	FWS is working with Scott Guyer and Ducks Unlimited to refine the request for an updated vegetation map. Further conversations among FWS regulatory staff, industry and Ducks Unlimited may indicate the need for a high quality, high resolution vegetation map that includes the NHD and hydrography, which would serve the same purpose as an updated NWI classification map. Updated NWI is needed for 1002 planning purposes, but FWS could make a future request from the USGS 3DEP program for Lidar to complete hydrography mapping.						
Birds	Provide contemporary information on distribution and abundance and important habitat areas for birds	To ensure compliance with Migratory Bird Treaty Act and identify important bird habitat to guide stipulations in EIS	Conduct aerial- or ground-based inventories of breeding birds. Species groups should include waterfowl, loons, gulls, shorebirds, and landbirds and should also include both area-wide and site-specific surveys. Prioritization of surveys should be done by common species because year-to-year variability will require baseline data to be collected over several years, surveys should begin as soon as possible.	\$25,000 for expanded Arctic capability; \$40,000 to contract for regional survey in 2018; \$100,000 to match funding from non-DOI partners (should be repeated for 3+ yrs)	3	1	1	0	0	1	1	USGS is completing an analysis of USFWS Arctic Coastal Plain waterbird aerial survey data to examine change in abundance and distribution of species over a 26-year period for entire Arctic Coastal Plain (ACP; includes NWR, Arctic Slope, and coastal plain areas). Final product to be available in Spring 2018. Additional analyses could be undertaken depending upon need.	This could be accomplished by expanding interest of current Arctic Coastal Plain waterbird survey within 1002 area. Program for Regional and International Shorebird Monitoring (PRISM) methods for intensive and passive monitoring of shorebirds (ground and aerial based) would be needed for shorebirds and landbirds. Barrier Island surveys for nest densities (common eiders)						
Water	Characterize seasonality in water quantity and quality in primary rivers of 1002 area	Understanding river flow is needed to inform transportation planning and water withdrawal permitting	Conduct continuous water quality and quantity monitoring on the Hulahula, Tamayariak, and Canning rivers to examine the current status and seasonal variability in late fall and spring surface water quality and quantity in relation to the timing of fish use and industrial activity. Compile information in a database that will be used for permitting and impacts analyses.	\$175,000	5	0	1	1	1	1	1	Currently USGS operates gage on the Hulahula River. USGS contributed \$25,000 in FY18 to continue gage activity. Support in outyears TBD.	This might be a good fit for the USGS Quick Response and Science Support funding opportunity. Arctic LCC has some hydrologic information available via USGS from TEON site on Agashashok River. Future conversations with NOAA about potential opportunities for shared delivery of monitoring data. Could be opportunity to work with USGS Cooperative Unit at UAF on hydrologic modeling.						

Snow	Create and/or Evaluate Snow Distribution Models to capture snow depth across the 1002 Area	To be able to identify annually snow drifts with highest probability to create potential polar bear denning habitat (therefore, minimum snow required for winter tundra travel to predict tundra travel in the 1002 area during exploration and development.)	Snow depth and drifting monitoring and calibration of snow model for 1002 area. A combination of snow, wind and temperature monitoring stations and ground surveys, as well as high-resolution digital elevation models will be used to create a more accurate snow model for the 1002 area. USGS has received funding from NASA to collect aircraft-based imagery of snow levels in April 2018, and funding is requested to conduct ground truthing by snowmachine surveys. This would provide a preliminary baseline for snow depth in polar bear denning habitat and for winter tundra travel. Continued operation of 3 remote meteorological stations will continue to provide snow, wind, and precipitation (including snow). Addition of 2-3 NRCS run SNOTEL sites would improve spatial coverage (13.3 km ² / \$10K per site, assuming NRCS provides SNOTEL (NRCS contribution possible)). This information, coupled with requested vegetal map and high-resolution topographic map, may allow us to plan future monitoring and aerial imagery acquisition to inform an improved snow model based off the SnowBeds 3D Model developed by Dr. Glen Liston through a previous NFWF grant.	2018: \$12K for winter fieldwork; \$30-100K for SNOTEL initiation (NRCS contribution would decrease) / \$1K per annum for SNOTEL operation	1+	1	1	1	1	1	1	USGS has three climate stations within the 1002 area and is investigating support of maintenance activities for FY18. Regarding snow, USGS recommends contacting NSIDC to explore use of remotely sensed imagery. MODIS MOD10A1 and MYD10A1 have a snow cover parameter, which uses the Normalized Difference Snow Index (NDSI) and is updated daily, with temporal coverage dating back to 2000. The MODIS data is available at http://nsidc.org/data/MOD10A1 , http://nsidc.org/data/MYD10A1 . Seismic operations do not have a snow extent parameter, but is an 8-day product with temporal coverage dating back to 2000. The Seismic Operations and Snow Extent (NSE) data set provides daily, global maps of sea ice concentration and snow extent. The resolution is much lower compared to MODIS, however, (http://nsidc.org/data/NSE)	Dr. Matthew Sturm of UAF was able to secure funding from NASA to fly preliminary LiDAR and Structure for Motion (SfM) imagery over Alaska. This imagery and associated ground truthing needs to be ground-truthed for validation. Dr. Frank Urban of USGS is able to help with ground truthing of the seismically monitors snow across the north slope, including NPPA and the 1002 area, at his remote stations. FWS has agreed to provide funding for air travel and logistics April 10-19. BLM will make Fairbanks Field Office employee Eric Urban available to support Dr. Urban and FWS will pay Eric's travel. Another component of this work is flying the aircraft to the north slope and green up to get the snow-free topography. The difference between April and Snow-free is used to calculate snow depth.					
Air-Quality	Compile information needed for exploration permitting	Existing monitoring data are likely insufficient to support Air Quality (AQ) and Climate Quality (CQ) analyses, which are required for oil and gas exploration and development EISs on federal lands--	Review (including exploratory modeling) of existing monitoring data and potential substitute data. Also requires information on geographic areas, nearby sensitive areas, and potential sources of pollution. This application could take 1 week - 1 month after receipt of complete application. For exploratory drilling and production, contracts are months after project is clearly defined. For environmental assessments, these are conducted by BLM Air Program and USEWS Branch of Air and Water-Quality Resources. Existing data may include information on air quality in the Arctic National Wildlife Refuge and average patterns of potential pollution dispersion (limited NOAA/NWS/AA data, BLM/NRA ozone study, Beaufort Lake Field Station research, and industry sponsored PM4 speciation studies at Wainwright and Deadhorse).	Seismic operations: 1 month; exploratory drilling/production: 6 months	1-4 technical specialist EISs from BLM/NRA							Action-needed when a seismic application is received. Continued conversations between FWS and BLM could refine the Recommended Action						
Caribou	Monitor caribou migration and habitat use prior to development.	ANILCA: Int'l Agreement for Conservation of Porcupine Caribou Herd	Monitoring data are needed to identify calving areas and seasonal ranges and to identify sensitive areas. Current and recent data will be used to work with industry to ensure habitat connectivity where possible.	\$250,000	5	±	±	0	±	±	USGS is conducting research on the Central Arctic Herd. USGS is exploring possible engagement with the Porcupine Herd Technical Committee who hold and manage data relative to this resource need.	changes in adult female survival rates (roughly 1-5% or set); increasing the sample of collared adult females would be helpful to better understand whether info needs identified for caribou, particularly, improved estimates of calving sites and birth rates; seasonal ranges; migration routes; calving patterns, etc. Thus, this is really the						
Caribou	Analyze existing telemetry data to quantify seasonal ranges and migration routes	ANILCA, Int'l Agreement for Conservation of Porcupine Caribou Herd	A large database of telemetry data exists that could provide valuable baseline information on caribou migration. These data need to be analyzed and used to update the report "Seasonal Habits of the Porcupine Caribou Herd" (International Porcupine Caribou Board, 1993); this information is needed to identify sensitive areas and ranges. This will be used to support management and production. Funding is for time for a wildlife ecologist to analyze data and prepare a report, to be reviewed by wildlife biologists at federal, state and regional agencies.	Nearly complete		1	1	2	0	1	1	USGS is conducting research on the Central Arctic Herd. USGS is exploring possible engagement with the Porcupine Herd Technical Committee who hold and manage data relative to this resource need.	This study appears to be nearly complete. The Porcupine Committee (Mike Sutor, Canada as lead), as an update to Griffith et al. 2002. Research findings are interesting, but the PCTC, some uncertainty about publishing given uncertainty about PCTC					

Table 2. Implementation of Fiscal Year 2018 Activities for Information C

Project Title	Description
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Modernization of Satellite Radio Collars (FWS/USGS)	<p>The use of satellite radio collars is essential to our ability to gather information on polar bear population dynamics and habitat use patterns. However, current satellite radio collars utilize an unreliable release mechanism such that collars that are past their functional life are not falling off the animals. Because of this, the public has expressed serious concerns about the use of satellite radio collars for monitoring polar bear populations.</p>
Development of a Population Monitoring Plan for SBS Polar Bears (FWS/USGS)	<p>field research effort, analysis of data, and routine updates to the</p>
Development of an Annual Den Detection and Monitoring Plan for the 1002 Area (FWS/USGS)	<p>Analyze existing information on den occurrences in the 1002 Area.</p>
Implementation of Polar Bear Den	<p>February 2018 on a section of coastline in the 1002 area and</p>

Detection and Monitoring Plan for
the 1002 Area (FWS/USGS)

	Assess effectiveness of existing and experimental den detection survey methods.
Community Perspectives and Use of Polar Bears in the 1002 Area (FWS)	Develop study design and begin implementation for baseline data collection.
Polar Bear Response to Anthropogenic Disturbance (FWS)	Bay and NPR-A to analyze the relationship between forms of disturbance at polar bear den sites and concomitant polar
Evaluate Efficacy of Existing Mitigation Measures (FWS)	Comprehensive review of management measures applied to existing Industry operations (i.e. buffer zones, seasonal/area restrictions, facility location/design).

collection on Polar Bears in Relation to Oil and Gas Development
Methods

Issue a Request for Proposals (RFP) for development of a reliable collar release mechanism to insure that satellite radio collars reliably release from the animal when they are past their functional life.

Hire a GS-11/12 research biologist to develop and implement the monitoring plan.
managers to develop a joint study plan, determine roles and responsibilities for
Meet with Alaska Native subsistence hunters to discuss methods and timing of study.

Hire a GS 11/12 research biologist to review data from collared bears as well as update habitat modeling using modern satellite technology such as LIDAR.

Issue an RFP for FLIR surveys to be conducted during February of 2018.
Secure additional server capacity for FLIR images and hire a GS 11/12 computer technician to help process imagery.
Hire a GS11/12 biologist to process imagery and analyze den detection survey data.

false positives and false negatives in den detection surveys in order to develop a

Issue a RFP for study design and implementation

~~Hire a GS 7/9 biologist to query existing data and a GS 11/12 biologist to analyze that data. Hire a GS 9/11 acoustician and acquire sound monitoring and camera systems for den monitoring.~~
~~Hire a GS 9/11 biologist to compile review and document basis for existing management measures and their efficacy in the field.~~
~~Utilize 50% of a GS 9/11 biologist to investigate possible application of existing management measures to the 1002 area.~~

Gas Development in the 1002 Area of the Arctic Nation

Cost

\$250,000
\$150,000

\$35,000

\$15,000

\$150,000

\$750,000

\$250,000

\$150,000

\$150,000

\$200,000

\$250,000

\$200,000

\$100,000

\$50,000

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\$150,000

\$150,000

\$200,000

\$250,000

\$200,000

\$100,000

\$50,000

Birds

If you have ideas for projects that will fill high priority needs for bas

- 2018
 - Conduct area-wide aerial surveys of breeding waterfowl, loons, and larid
 - o Expansion of existing Mig Bird ACP survey.
 - o Average annual budget first 3 years: 25K
- 2019
 - Conduct ground-based surveys of breeding waterfowl and gulls on barrie
 - o Average annual budget first 3 years: 40K
- 2019
 - Conduct intensive ground-based surveys of tundra breeding birds (includ
 - o Average annual budget first 3 years: 65K
- Industry?
 - Conduct aerial- or ground-based surveys of the Brooks Range, foothills, a
 - o Average annual budget first 3 years: 10K
- 2019
 - Conduct area-wide ground-based surveys of breeding shorebirds and landbir
 - o Average annual budget first 3 years: 70K
- 2019
 - Conduct area-wide ground-based nest survival study, using temperature pro
 - o 2019 cost: \$15K
 - o 2020 and succeeding years: \$75K per year
- 2019
 - Conduct data archive, analysis, and mapping of marine birds in coastal and o Average annual budget first 3 years: \$50K
- 2019
 - Prepare for & coordinate with vessel-based studies to conduct marine bird su
 - o Annual budget in 2019 & 2020: 35K
- 2020
 - Conduct marine bird surveys in coastal & marine waters offshore of and 'dov
 - o Annual budget for 2020-2023: \$50K

Latty's draft ranked list for FY19 funding (bird group - please call me if you di

- 1 Data management
 - Cost - at minimum 50K/year for the new/ongoing ARCP bird data.
- 2 Conduct focused, intensive aerial breeding waterbird surveys (an extension
 - 2019 cost - \$0? Can be included in existing Mig Bird surveys (I'll
 - 2020 cost - \$0? Can be included in existing Mig Bird surveys (I'll
- 3 Conduct aerial surveys of post-breeding waterbirds in lagoons.
 - Based on availability of Mig Bird assets, cost of contracting this si
 - Cost would be ~ 100K/year

- Wouldn't start till summer 2020, but would like to begin contract
Suggest we begin exploring options for this and potentially fund it
- 4 Conduct ARCP-wide breeding ground-based surveys for ALL species groups (# of years and intensity of surveys/yr should be based on decision
2019 cost - \$0 (NFWF/Manomet funding secured)
- 5 Conduct studies to develop methods to determine red and arctic fox abundance
2019 costs - \$0 (In-house and I&M funding secured)
- 6 Collect baseline data on nest survival ARCP-wide using remote sensing techniques
2019 costs - \$30K
2020 costs - TBD based on results of 2019
- 7 Conduct aerial surveys of the Brooks Range, foothills, and Coastal Plain for birds
2019 costs -\$0 (probably out of time to coordinate for this summer)
2020 costs - \$20K
- 8 Collect data on habitat use, residency time, site fidelity for birds using the Aerial surveys
2019 costs - \$20K
2020 costs - 50K
Costs are expected to be >100K/yr, but most funds will come from other sources

Latty's ask from Wendy for 2019 for currently unfunded bird work directly related to the Arctic Refuge

baseline data or to inform near-term (next 5 years) management actions, please call me to discuss. Thanks! Latty
s to provide contemporary abundance and distribution.

or islands to provide contemporary abundance and distribution.

ling waterfowl, shorebirds, loons, gulls, ptarmigan, and passerines) at several sites across a variety of habitats and acquire/c
and Coastal Plain rivers for breeding cliff-nesting raptors to provide contemporary abundance and distribution.

nds to provide contemporary abundance and distribution using PRISM techniques

bes and cameras to assess nest survival rates and predator assemblages. Given annual variability in nest survival, it is esse

offshore areas, using data collected under BOEM Interagency Agreement with MBM

surveys in 2020-2023; travel to meetings, hiring, training, equipment

vnstream' of 1002 area and ports, leveraging BOEM-funded surveys which end in 2020.

isagree :) **907 347 4300**

Costs would be much higher to deal with the old data. This should be the #1 need for all 1002 disciplines not just the bird

of the ACP survey and building on last years data). The focus will be on areas with 1) higher densities in the 2018 ARCP wid
double check this with Julian)
double check this with Julian)

urvey, and need for data collection across the molting period (ie not a 1 day snapshot), I would suggest we explore a postdo

ng this with a University as soon as practical.
n late summer/early fall if funds are available.
shorebirds, landbirds, larids, waterfowl, loons)
ns of biometritions specific to meet ARCP data needs.

nce and distribution in areas most likely to see development in the mid-term and begin to address how individuals differenti
niques for ALL tundra breeding birds

breeding cliff-nesting raptors to provide contemporary abundance and distribution.
er)

RCP for breeding and non-breeding using remote sensing devices. This data will highlight important habitats, inform phenol

n outside this RFP from sources such as other FWS offices, USGS, BOEM, NSF, NFWF, NPRB, CMI, Universities, and NGOs

ated to the 1002 = \$100K (plus up to additional 200K by 9/15 to fund #3)

create high-resolution maps of potential habitat quality indices (e.g., vegetation, elevation, snow, microclimate). Ecologic

ntial to get multiple years of data. Most of 2019 costs are covered (all but purchasing camera costs) but air support for 2

work - I'd suggest all projects have 30% overhead added to their project cost that would go to the data managers (not PIs
e survey and 2) areas expected to be of higher interest for future development (ie where the oil is most likely to occur)

c to build a UAV survey

ally depredate nests

ogy for management actions, and provide data on residency time to be used with surveys to estimate population sizes

al mapping data can then be used to define fine scale, species-specific habitat.

020 and succeeding years is needed, which could happen by transferring 2019 funds to an outside entity through a cooperat

s - actual ARCP dedicated data managers - someone like Josh Bradley) for them to build a robust noralized spatial database t|

ive agreement.

hat can be accessed, manipulated, and downloaded by all parties (internal gov, external gov, NGO, public).

